Amendments to the Claims

Please amend Claims 58, 63, and 68. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1. (Previously Presented) A method for determining, in an electrical signal, a presence of sinusoids used to encode dialed digits, the method comprising:

splitting the electrical signal into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

at the sampling frequency, analyzing energies within the subbands to determine the presence of the sinusoids.

2. (Cancelled)

3. (Original) The method according to Claim 1, wherein splitting the electrical signal into the subbands comprises filtering the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter.

4. (Original) The method according to Claim 3, wherein the PS-IIR filters are implemented in a polyphase form.

5. (Original) The method according to Claim 3, wherein the PS-IIR filters comprise all-pass sections implemented in compact realizations.

6. (Original) The method according to Claim 1, further comprising filtering the subbands with at least one bank of filters comprising filters corresponding to the number of possible frequencies of the sinusoids within the respective subbands.

7. (Original) The method according to Claim 6, wherein the filters are notch filters.

8. (Original) The method according to Claim 6, wherein, for DTMF detection, splitting the electrical signal comprises (*i*) extracting a 0-1 kHz subband and a 1-2 kHz subband and (*ii*) filtering the subbands with four notch filters per bank of filters.

9. (Original) The method according to Claim 6, wherein, for MF-R1 detection, splitting the electrical signal comprises (*i*) extracting a 0-1 kHz subband and a 1-2 kHz subband and (*ii*) filtering the 0-1 kHz subband with two notch filters and the 1-2 kHz subband with four notch filters.

10. (Original) The method according to Claim 6, wherein:

for MF-R2 forward detection, splitting the electrical signal comprises (*i*) extracting a 0-1 kHz subband and 1-2 kHz subband and (*ii*) filtering the 1-2 kHz subband with six notch filters; and

for backward detection, splitting the electrical signal comprises (*i*) extracting a 0-1 kHz subband and a 1-2 kHz subband and (*ii*) filtering the 0-1 kHz subband with a notch filter at 980 Hz, to remove aliasing of a 1020 Hz tone in the 1-2 kHz subband, and four other notch filters and the 1-2 kHz subband with two notch filters.

11. (Original) The method according to Claim 6, further comprising preclassifying the sinusoids in the subbands and selecting filters within respective banks of filters that match frequencies of the preclassified sinusoids.

12. (Original) The method according to Claim 1, wherein analyzing the energies comprises determining whether a summing of the energies in the subbands exceeds a minimum threshold level.

13. (Original) The method according to Claim 1, wherein analyzing the energies comprises determining whether a difference between the energies in the subbands is below a twist-test threshold.

14. (Original) The method according to Claim 1, wherein for each subband, analyzing the energies comprises comparing energy levels of an output of a notch filter having a lowest output energy level from among at least two notch filters in a bank of filters to the energy of the input signal to the bank of filters.

15. (Original) The method according to Claim 1, wherein analyzing the energies further comprises reporting valid dialed digits.

16. (Original) The method according to Claim 1, wherein the electrical signal is sampled by an analog-to-digital converter and splitting and analyzing the electrical signal is executed by a digital processor.

17. (Previously Presented) An apparatus, comprising:

a splitter to separate an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

an analyzer, operating at the sampling frequency, to measure energies within the subbands to determine a presence of the sinusoids.

18. (Cancelled)

19. (Original) The apparatus according to Claim 17, wherein the splitter comprises a power symmetric infinite impulse response (PS-IIR) filter to separate the signal into subbands.

20. (Original) The apparatus according to Claim 17, further comprising at least one bank of filters to filter the subbands, the bank of filters comprising filters corresponding to the number of possible frequencies of sinusoids within the respective subbands.

21. (Original) The apparatus according to Claim 20, wherein the filters are notch filters.

22. (Original) The apparatus according to Claim 20, further comprising at least one preclassifier to determine the sinusoids in the subbands and to select filters within respective banks of filters that match frequencies of the sinusoids.

23. (Original) The apparatus according to Claim 17, wherein the electrical signal is sampled by an analog-to-digital converter and the splitter and analyzer are implemented in digital processor instructions and executed by a digital processor.

24. (Original) The apparatus according to Clam 17 being employed in a device supporting voice-over-IP.

25. (Previously Presented) An apparatus, comprising:

an analog-to-digital converter sampling a received analog signal, including sinusoids corresponding to frequencies of dialed digits, and outputting a corresponding digital signal; and

a digital processor coupled to an output of the analog-to-digital converter to receive the digital signal, the digital signal processor executing program instructions to:

split the digital signal into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

at the sampling frequency, analyze energies within the subbands to determine a presence of the sinusoids.

26. (Cancelled)

27. (Original) The apparatus according to Claim 25, wherein the program instructions to split the electrical signal into the subbands comprise instructions to filter the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter.

28. (Original) The apparatus according to Claim 25, further comprising program instructions to filter the subbands with at least one bank of filters comprising filters corresponding to the number of possible frequencies of sinusoids within the respective subbands.

29. (Original) The apparatus according to Claim 28, wherein the filters are notch filters.

30. (Original) The apparatus according to Claim 28, further comprising program instructions to preclassify the sinusoids in the subbands and select filters within respective banks of filters that match frequencies of the preclassified sinusoids.

31. (Original) The apparatus according to Claim 25 employed in a device supporting voice-over-IP.

32. (Previously Presented) An apparatus, comprising:

means for splitting an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

means for analyzing, at the sampling frequency, energies within the subbands to determine a presence of the sinusoids.

33. (Original) The apparatus according to Claim 32 employed in a device supporting voice-over-IP.

34. (Previously Presented) A computer-readable medium having stored thereon sequences of instructions, the sequences of instructions including instructions, when executed by a processor, causes the processor to perform:

splitting an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

at the sampling frequency, analyzing energies within the subbands to determine a presence of the sinusoids.

35. (Cancelled)

36. (Previously Presented) The computer-readable medium of Claim 34, wherein splitting the electrical signal into subbands comprises filtering the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter.

37. (Original) The computer-readable medium of Claim 34, further comprising instructions which, when executed by the processor, causes the processor to filter the subbands with at least one bank of filters comprising filters corresponding to the number of possible frequencies of sinusoids within the respective subbands.

38. (Original) The computer-readable medium of Claim 37, wherein the filters are notch filters.

39. (Original) The computer-readable medium of Claim 37, further comprising instructions which, when executed by the processor, causes the processor (*i*) to preclassify the sinusoids in the subbands and (*ii*) to select filters within respective banks of filters that match frequencies of the preclassified sinusoids.

40. (Previously Presented) A voice-over-IP device, comprising:

a receiver receiving electrical signals composed of voice signals and dialed digit sinusoids corresponding to dialed digits;

a detector coupled to the receiver to monitor the electrical signals and to detect the dialed digit sinusoids, said detector including:

a splitter to split the electrical signal into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits;

an analyzer, operating at the sampling frequency, to analyze energies within subbands to determine a presence of the sinusoids; and

a generator to generate packets of data comprising (*i*) voice signal data and (*ii*) information corresponding to the dialed digits.

41. (Cancelled)

42. (Previously Presented) The method according to Claim 1 wherein splitting the electrical signal is performed at about the highest frequency of the sinusoids.

43. (Previously Presented) The method according to Claim 1 wherein analyzing the energies is performed at about the highest frequency of the sinusoids.

44. (Cancelled)

45. (Previously Presented) The apparatus according to Claim 17 wherein the splitter operates at about the highest frequency of the sinusoids.

46. (Previously Presented) The apparatus according to Claim 17 wherein the analyzer operates at about the highest frequency of the sinusoids.

47. (Cancelled)

48. (Previously Presented) The apparatus according to Claim 25 wherein the program instructions to split the digital signal into subbands split the digital signal at about the highest frequency of the sinusoids.

49. (Previously Presented) The apparatus according to Claim 25 wherein the program instructions to analyze the energies of the digital signal analyze the energies at about the highest frequency of the sinusoids.

50. (Cancelled)

51. (Previously Presented) The computer-readable medium of Claim 34 wherein splitting the electrical signal is performed at about the highest frequency of the sinusoids.

52. (Previously Presented) The computer-readable medium of Claim 34 wherein analyzing the energies is performed at about the highest frequency of the sinusoids.

53. (Previously Presented) The method according to Claim 1 wherein the sampling frequency is about 2 kHz.

54. (Previously Presented) The apparatus according to Claim 17 wherein the sampling frequency is about 2 kHz.

55. (Previously Presented) The apparatus according to Claim 25 wherein the sampling frequency is about 2 kHz.

56. (Previously Presented) The computer-readable medium of Claim 34 wherein the sampling frequency is about 2 kHz.

57. (Previously Presented) The computer-readable medium of Claim 40 wherein the sampling frequency is about 2 kHz.

58. (Currently Amended) A method for determining, in an electrical signal, a presence of sinusoids used to encode dialed digits, the method comprising:

rate change splitting the electrical signal into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

analyzing energies within the subbands to determine the presence of the sinusoids corresponding to frequencies of the dialed digits.

59. (Cancelled)

60. (Previously Presented) The method according to Claim 58, wherein rate change splitting the electrical signal into the subbands comprises filtering the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter.

61. (Previously Presented) The method according to Claim 60, wherein the PS-IIR filter is implemented in a polyphase form.

62. (Previously Presented) The method according to Claim 60, wherein the PS-IIR filters comprise all-pass sections implemented in compact realizations.

63. (Currently Amended) An apparatus, comprising:

a splitter that separates and decimates an electrical signal into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

an analyzer that measures energies within the subbands to determine a presence of sinusoids corresponding to frequencies of dialed digits.

64. (Cancelled)

65. (Previously Presented) The apparatus according to Claim 63, wherein the splitter comprises a power symmetric infinite impulse response (PS-IIR) filter to separate the signal into subbands.

66. (Previously Presented) The method according to Claim 65, wherein the PS-IIR filter is implemented in a polyphase form.

67. (Previously Presented) The method according to Claim 65, wherein the PS-IIR filters comprise all-pass sections implemented in compact realizations.

68. (Currently Amended) An apparatus for determining, in an electrical signal, a presence of sinusoids used to encode dialed digits, the method comprising:

means for rate change splitting the electrical signal into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits; and

means for analyzing energies within the subbands to determine the presence of the sinusoids corresponding to frequencies of the dialed digits.

69. (Previously Presented) A method for determining, in an electrical signal, a presence of sinusoids used to encode dialed digits, the method comprising:

splitting the electrical signal into subbands being at a sampling frequency of less than twice the highest frequency used to encode dialed digits, splitting the electrical signal into the subbands comprising filtering the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter; and

at the sampling frequency, analyzing energies within the subbands to determine the presence of the sinusoids.

70. (Previously Presented) The method according to Claim 69, wherein splitting the electrical signal into the subbands comprises extracting subbands of 0-1 kHz and 1-2 kHz.

71. (Previously Presented) The method according to Claim 69, wherein the PS-IIR filter is implemented in a polyphase form.

72. (Previously Presented) The method according to Claim 69, wherein the PS-IIR filter comprises all-pass sections implemented in compact realizations.

73. (Previously Presented) An apparatus, comprising:

a splitter to separate an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands being at a sampling frequency of less than twice the highest frequency used to encode dialed digits, the splitter comprising a power symmetric infinite impulse response (PS-IIR) filter to separate the signal into subbands; and

an analyzer, operating at the sampling frequency, to measure energies within the subbands to determine a presence of the sinusoids.

74. (Previously Presented) The apparatus according to Claim 73, wherein the splitter extracts subbands of 0-1 kHz and 1-2 kHz.

75. (Previously Presented) The apparatus according to Claim 73, wherein the PS-IIR filter is implemented in a polyphase form.

76. (Previously Presented) The apparatus according to Claim 73, wherein the PS-IIR filter comprises all-pass sections implemented in compact realizations.

77. (Previously Presented) An apparatus, comprising:

an analog-to-digital converter sampling a received analog signal, including sinusoids corresponding to frequencies of dialed digits, and outputting a corresponding digital signal; and

a digital processor coupled to an output of the analog-to-digital converter to receive the digital signal, the digital signal processor executing program instructions to:

split the digital signal into subbands being at a sampling frequency of less than twice the highest frequency used to encode dialed digits, the program instructions to split the electrical signal into the subbands comprising instructions to filter the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter; and

at the sampling frequency, analyze energies within the subbands to determine a presence of the sinusoids.

78. (Previously Presented) The apparatus according to Claim 77, wherein the program instructions to split the digital signal into subbands comprise instructions to extract subbands of 0-1 kHz and 1-2 kHz.

79. (Previously Presented) The apparatus according to Claim 77, wherein the PS-IIR filter is implemented in a polyphase form.

80. (Previously Presented) The apparatus according to Claim 77, wherein the PS-IIR filter comprises all-pass sections implemented in compact realizations.

81. (Previously Presented) A computer-readable medium having stored thereon sequences of instructions, the sequences of instructions including instructions, when executed by a processor, causes the processor to perform:

splitting an electrical signal, including sinusoids corresponding to frequencies of dialed digits, into subbands being at a sampling frequency of less than twice the highest frequency used to encode dialed digits, splitting the electrical signal into subbands comprising filtering the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter; and

at the sampling frequency, analyzing energies within the subbands to determine a presence of the sinusoids.

82. (Previously Presented) The computer-readable medium of Claim 81, wherein splitting the electrical signal into subbands comprises extracting subbands of 0-1 kHz and 1-2 kHz.

83. (Previously Presented) The computer-readable medium of Claim 81, wherein the PS-IIR filter is implemented in a polyphase form.

84. (Previously Presented) The computer-readable medium of Claim 81, wherein the PS-IIR filter comprises all-pass sections implemented in compact realizations.

85. (Previously Presented) A method for determining, in an electrical signal, a presence of sinusoids used to encode dialed digits, the method comprising:

rate change splitting the electrical signal into subbands, rate change splitting the electrical signal into the subbands comprising filtering the electrical signal using a power symmetric infinite impulse response (PS-IIR) filter; and

analyzing energies within the subbands to determine the presence of the sinusoids corresponding to frequencies of the dialed digits.

86. (Previously Presented) The method according to Claim 85, wherein splitting and decimating the electrical signal into the subbands comprises extracting subbands of 0-1 kHz and 1-2 kHz.

87. (Previously Presented) The method according to Claim 85, wherein the PS-IIR filter is implemented in a polyphase form.

88. (Previously Presented) The method according to Claim 85, wherein the PS-IIR filters comprise all-pass sections implemented in compact realizations.

89. (Previously Presented) An apparatus, comprising:

a splitter that separates and decimates an electrical signal into subbands, the splitter comprising a power symmetric infinite impulse response (PS-IIR) filter to separate the signal into subbands; and

an analyzer that measures energies within the subbands to determine a presence of sinusoids corresponding to frequencies of dialed digits.

90. (Previously Presented) The apparatus according to Claim 89, wherein the splitter extracts subbands of 0-1 kHz and 1-2 kHz.

91. (Previously Presented) The apparatus according to Claim 89, wherein the PS-IIR filter is implemented in a polyphase form.

92. (Previously Presented) The apparatus according to Claim 89, wherein the PS-IIR filter comprises all-pass sections implemented in compact realizations.